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TABLE OF CONTENTS

The Integumentary Sense Organs of the Larvæ of Rhipicephalinæ (Acarina). *J. Dinnik* and *F. Zumpt* 1

On the Status of *Cryptocerus* Latreille and *Cephalotes* Latreille (Hymenoptera: Formicidæ). *M. R. Smith* 18

Strumigenys venatrix Wesson and Wesson Synonymous with *S. talpa* Weber. *L. G. Wesson, Jr.* 21

The Male of *Prodidomus rufus* Hentz (Prodidomidæ, Araneæ). *E. B. Bryant* 22

Some Flies of the Genus *Volucella* from the New World. *F. M. Hull* 26

Synonymic and Other Notes on Formicidæ (Hymenoptera). *W. L. Brown, Jr.* 41

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PSYCHE

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THE INTEGUMENTARY SENSE ORGANS OF THE LARVÆ OF RHIPICEPHALINÆ (ACARINA)[1]

BY J. DINNIK and F. ZUMPT[2]

In 1938 Delpy published a short paper describing the location and morphology of the so-called spiracles or respiratory plates ("stigmates respiratoires") of various Ixodid larvæ. He examined for the purpose *Hyalomma dromedarii* Koch, *H. impressum* Koch, *Boophilus annulatus* Say, *Rhipicephalus bursa* Can. and Fanz., and *Hæmaphysalis cinnabarina punctata* Can. and Fanz. Delpy's description is brief and lacks illustrations. He thought that he saw within each "spiracle" 1 or 2 pores, sometimes reduced in size, leading into an atrium provided with two valves at the entrance. The base of the atrium he described as pierced with an opening, and Delpy considered it possible that a tracheal tube was attached at this point.

With regard to their position, Delpy distinguished coxal and abdominal spiracles. The coxal spiracles are in three pairs, placed behind each of the six coxæ. The abdominal spiracles vary greatly in number and position according to the genus. *Hæmaphysalis* is said to have four pairs, *Hyalomma* and *Rhipicephalus* only one pair, while they are entirely lacking in *Boophilus*.

Delpy was not the first, however, to describe supposed spiracles in Ixodid larvæ. Salmon and Stiles (1902) saw them before, and they were also mentioned by Oudemans (1906), Zebrowski (1926) and Cooley (1938).

---

[1] Preliminary Study No. 10 for a Revision of the Genus *Rhipicephalus* Koch. Nos. 1 to 8 of this series were published in the Zeitschrift für Parasitenkunde from 1939 to 1943. No. 9 is to appear in Dechiana (Festschrift f. Prof. Reichensperger).

[2] Now at The South African Institute for Medical Research, Johannesburg, South Africa.

All these authors were mistaken in the interpretation of the function of the organ they had seen. The larvæ of the Ixodidæ do not possess any special respiratory organs. Only Samson (1908) correctly recognized that the so-called "larval spiracles" described by Salmon and Stiles were actually the terminal pores of integumentary sense organs. This correction was, however, overlooked up to quite recently. Even Vitzthum, in his account of the Acarina for "Bronn's Klassen und Ordnungen des Tierreichs" (1940), adopted in detail the description and views of Delpy.

K. W. Neumann (1942) and Elishewitz (1942) first reexamined these structures in an attempt to decide whether they were respiratory organs or integumentary glands. Serial sections of larvæ of *Dermacentor*, *Hæmaphysalis*, *Hyalomma* and *Ixodes* convinced Neumann that neither the Ixodinæ (Prostriata) nor the Rhipicephalinæ (Metastriata) have respiratory organs and that the structures thus far interpreted as spiracles are really integumentary glandular organs.

According to Neumann, these organs are in a direct view more or less oval in outline. "A broad ellipsoid chitinized frame at the periphery is attached to the surrounding cuticula by means of a narrow, prominent, striated edge. The lumen also is oval and contains two parallel, non-contiguous lips. Two small protuberances of the frame extend on each side into the lumen, keeping the lips from touching each other. By lowering the objective, a small circular opening may be recognized in the center between the lips."

"In a side view of the entire organ or in a section, the structure is also more or less elongate oval. The walls consist of a rather thick layer of chitin, decreasing in thickness from the base toward the surface opening. A short duct leads from the base toward the interior of the body. On either side of the mouth of this duct a tooth, anchored to the base of the organ, extends up into its lumen. Serial sections show that these teeth arise from a folding of the walls. Their length is approximately three-fourths of that of the entire organ."

"To what do these several parts correspond? The broad frame is the wall, the lips are the teeth, and the circular opening is the mouth of the short duct." (See Pl. 1, fig. 1.)

"The organ is securely anchored in the cuticula by the upper third of its length. The subjacent hypodermal cells are broader than high and surround the organ. The adjacent cells (?generative cells) are much higher than broad. Only two seem to be present, placed parallel to the margins of the lips. A large cell, considerably broader than high, lies beneath the organ, in close contact with the entire basal surface. The duct mentioned before is never long enough to pierce this basal cell, but ends with it without tapering downward. The duct is never lined with a tænidium. So far as can be detected, the plasma of this cell is slightly granular, but a prominent clear spot in the center may be interpreted as an internal vesicle. It follows from this description that the structure is an integumentary glandular organ, not a larval respiratory organ with a spiracle and a rudimentary trachea."

So much for K. W. Neumann's account of the morphology of his integumentary sense organ. In addition he discusses the number and position of these organs in various genera and believes to be justified in stating that originally two pairs were present. According to his account, all the spiracle-like organs show essentially the same structure, though they are sometimes reduced in size, and they seem undoubtedly to be peculiar to the larvæ. He does not mention any other integumentary sense organs besides these so-called "spiracles."

P. Schulze (1942*a*) published a detailed study of the integumentary sense organs of adult ticks and found, besides true sensory setæ (sensilla trichoidea), four other types of sensilla which he called *Sensilla auriformia* (ear-shaped organs), *Sensilla sagittiformia* (arrow-shaped organs), *Sensilla hastiformia* (spear-shaped organs), and *Sensilla laterniformia* (lantern-shaped organs).

Large numbers of these organs are located within the hard and soft chitinized integument of the body. On the other hand they are sparse on the legs and palps and, strangely enough, seem to be entirely missing on the cheliceræ. Characteristic for these sensilla is their connection with two glandular cells which extend partially into the sensory duct. These cells secrete into the duct a substance which emerges at the surface after passing an end organ. P. Schulze assumes that the secretion serves as a protective coating against evaporation within the sensillum and on the outer surface, and also as a chemical means of recognition between opposite sexes and individuals of one species.

The sensory function of the sensilla auriformia seems to be of a proprio-receptive nature, serving to perceive changes or shifts within the chitin. It is probable that the other three types, grouped together as "tuft-shaped" sense organs or krobylophores, are vibro-chemoreceptive organs, which react at the same time to chemical as well as to seismic stimulation. They evidently play an important part in the sexual life of the ticks.

We examined the larvæ of *Rhipicephalus sanguineus* Latr., *Rh. appendiculatus* Neum., *Rh. bursa* Can. and Fanz., *Rh. evertsi* Neum., *Rh. simus* Koch, *Hyalomma dromedarii* Koch, and *Boophilus calcaratus* Birula.

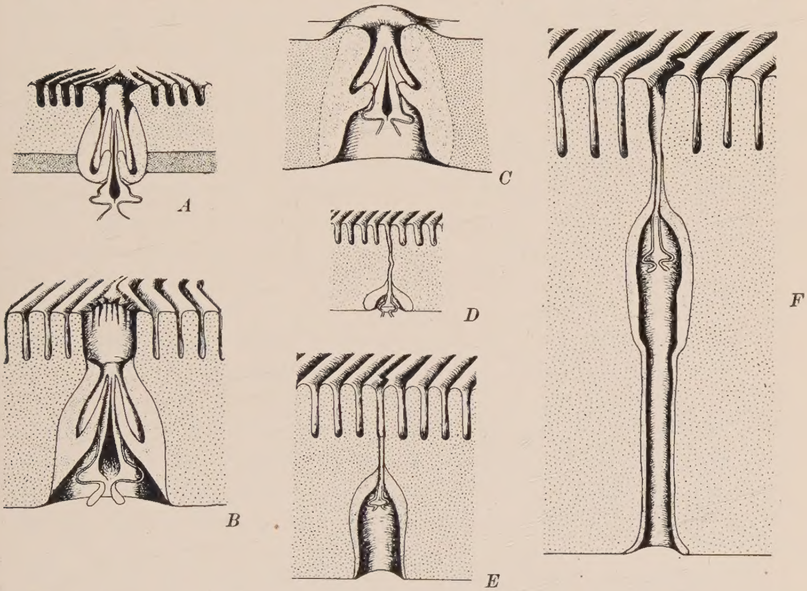
The larvæ were merely mounted whole on microscopic slides in Berlese's medium, a procedure which we found to be superior for our purpose to all other methods of mounting. Owing to prevailing conditions we were unable to make sections.

We were able to ascertain that the larvæ are not equipped with peculiar integumentary sense organs. On the contrary we found much the same organs present as in the adults and nymphs. In the larvæ, however, sensilla laterniformia seem to be lacking and the other types of sensilla are to some extent more primitive in development. The organs are distributed over the entire body in fixed numbers and in a definite arrangement.

A detailed account of the three types of sensilla mentioned above follows.

1. Sensilla sagittiformia (arrow-shaped organs)

The sensillum sagittiforme represents a new mode of sensory organ, called by P. Schulze a krobylophore sensory organ, because a tuft-shaped structure is its most striking characteristic. In the adult tick he described this organ as follows in side view (Pl. 1, fig. 2): "The distal portion of the chitinized passage or lumen appears arrow-shaped. Below this lies a narrow pagoda-shaped 'tuft' chamber and farther inside a small, more or less spheroidal 'terminal chamber.' This is separated from the middle chamber by projecting ledges which leave room only for a small circular opening. The innermost chamber is attached to a simple duct into which the glandular cells extend, enveloping the nerve cells. The surrounding chitin is especially thick beneath the lower portion of the 'arrow points.' The nerve cells decrease in size as they enter the 'terminal chamber.' The axial fiber is attached to a strong scolopale which enlarges to



Text-figure 1. A, Sensillum sagittiforme of the opisthosoma of *Rhipicephalus appendiculatus* Neum. B, Same in the larva. C, Same in the nymph. D, Sensillum hastiforme of *Rhipicephalus appendiculatus* Neum. E, Same in the nymph. F, Same in the adult female.

form a knot and then tapers down, becoming pointed again upon entering the 'pagoda-shaped chamber' in which the 'tuft' is located. This tuft has much the shape of a gas flame and is not chitinized but of a uniform structure, although at times it seems to be somewhat fibrillar.''

The larvæ we examined all show, contrary to Delpy's description, four pairs of spiracle-like structures, three of them behind the coxæ, the fourth on the opisthosoma (Pl. 2, figs. 4 and 5). A comparison of their inner structure (Text-fig. 1A–C) with P. Schulze's description and drawings clearly shows that these so-called ''larval spiracles'' are in reality sensilla sagittiformia. The finer structure of the organ is best seen in the opisthosomal pair of the larvæ of *Rhipicephalus appendiculatus* and *Boophilus calcaratus*. It is pear-shaped and pierces with its conical end the integument on the dorsal face of the fourth festoon. The walls are of thick chitin, the chitinous capsule being 0.012 to 0.016 mm. long and 0.011 to 0.014 mm. broad. A funnel-shaped fold is visible within the capsule. The narrow ends of this capsule, pointing toward the opening, are less strongly chitinized and look in direct view like a pair of lips lying within the capsule (compare Pl. 1, fig. 1). Within these lips lies the tuft-like structure, surrounded by a fine pagoda-like contour.

The sensilla sagittiformia behind the second and third coxæ are very similar in structure to the opisthosomal pair described above. On the other hand, the pair located behind the first coxæ at the edge of the scutum seems to have a strikingly thick-walled capsule which is fully embedded in the chitin of the scutum. It is 0.019 to 0.022 mm. long, 0.016 to 0.022 mm. wide at the base, with the opening 0.011 to 0.014 mm. in diameter. The ''tuft'' is difficult to recognize here, but is shaped as in the other pairs.

2. Sensilla hastiformia (spear-shaped organs)

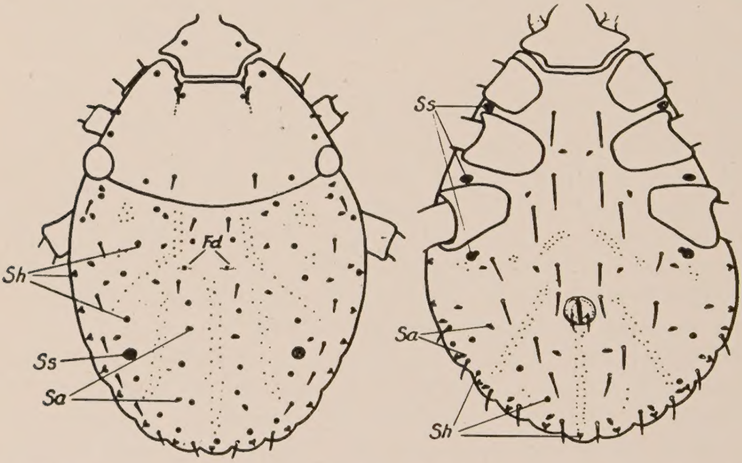
The sensilla hastiformia, as described by P. Schulze for the adult ticks, are much smaller than the arrow-shaped organs. He was unable to make out all the details of the terminal apparatus, but he presumed that they correspond in general to those of the sensilla sagittiformia and that a tuft-shaped structure is also present. The main difference lies, according to Schulze, in the upper portion of the passage leading to the outside. This lacks the long receding arrow-points, so that the "pagoda-shaped chamber," formed by these points, is also missing. The passage is distinctly spear-shaped, in as much as it expands into two mainly horizontal projections at the base.

The larval sensillum hastiforme could only be recognized as such after comparing it with the corresponding organ in nymphs and adults (Text-fig. 1, D–F). It lies as a short funnel-shaped structure in the lower part of the integument, which it pierces by means of a narrow passage, ending between the outer folds. The funnel-shaped portion is approximately 0.008 mm. in diameter and 0.005 mm. deep. The walls are about 0.002 mm. thick and the passage is roughly 0.008 mm. long.

We were also unable to recognize the finer structure of the organ, nor could we find anything comparable to a "tuft." In direct view the organ has the appearance of a ring, 0.008 mm. in diameter. Further details cannot be recognized, but by lowering the objective the duct leading inside the body may be followed.

The larvæ of *Rhipicephalus appendiculatus* Neum., *Rh. sanguineus* Latr., *Rh. bursa* Can. and Fanz., and *Rh. evertsi* Neum. studied by us, all have 54 sensilla hastiformia on the body proper; we did not examine the legs. The sensilla are placed strictly symmetrically and neither their position nor their number seem to vary to any extent (Pl. 3, fig. 6). One pair is located on the capitulum, occupying the position taken by the areæ porosæ of the adult female tick. Five pairs are situated on the scutum and nine pairs on the alloscutum, four of these dorsal, one subdorsal and four sublateral. In addition eight pairs are found on the edge of the alloscutum, one sensillum being placed on the edge of each festoon (or parmula), except on the middle festoon. The arrangement of these eight pairs is therefore metameric and seems to be derived from the primitive segmentation of the opisthosoma.

The "foveæ dorsales" of the larva consist of only one sensillum hastiforme each. The integumental folds bend around their openings, whereas on the contrary the openings of the other sensilla hastiformia lose themselves among the folds of the integument. Aside from the fact that the openings are more conspicuous, they do not differ from the usual type of sensilla hastiformia.



Text-figure 2. Arrangement of the integumentary sense organs of the larva of *Hyalomma dromedarii* Koch: Fd, foveæ dorsales; Sa, sensilla auriformia; Sh, sensilla hastiformia; Ss, sensilla sagittiformia.

Ventrally the body bears four pairs of sensilla hastiformia. One pair lies very close to the sensillum sagittiforme of the third coxa. In *Rh. appendiculatus* it is enclosed by the capsule of the sensillum sagittiforme, so that it is difficult to see. Though closely adjacent to it in the other species, the sensillum hastiforme is nevertheless clearly set off.

The number and the arrangement of the sensilla hastiformia of the larva of *Boophilus calcaratus* Birula (Pl. 3, fig. 7) are similar to those of the *Rhipicephalus*, except that we were unable to discover the two foremost pairs on the ventral side and that they seem to be missing also on the fourth and fifth festoons counting from the middle.

The larva of *Hyalomma dromedarii* Koch (Text-fig. 2) possesses more sensilla hastiformia than that of *Rhipicephalus.* It should be mentioned especially that the middle festoon also bears a terminal and a dorsal unpaired sensillum. In addition a sensillum hastiforme is located on the dorsal side adjacent to each of the second, third and fourth festoons. It is noteworthy that two pairs of sensilla hastiformia, instead of one pair, were found on the capitulum of one specimen in the position of the areæ porosæ of the adult female.

3. Sensilla auriformia (ear-shaped organs)

The sensilla auriformia discovered by P. Schulze (1942*a*) in adult ticks may be traced back with certainty to setæ or hairs. They are located directly under the cuticula and consist each of a flat disk, usually inclined a little toward one side, so that it closes outwardly the sensory duct ascending from below, like a lid with overlapping edges (Pl. 1, fig. 3). The disks vary in details and have the shape of an ear, a megaphone or a bell. Their openings face various directions, so that it is possible to see one sensillum in direct view and the other in side view when examining two of them placed close together.

The larval ticks also possess these sensilla in typical form, but the organs are smaller than in the adult. The disk is approximately 0.009 mm. in diameter. Arrangement and number again seem to be strictly uniform, but all the disks lean in one particular direction.

Ten pairs of sensilla auriformia were found on the alloscutum of all larvae of *Rhipicephalus* examined. Five pairs may be seen dorsally some distance from the median line and five pairs on the edge of the alloscutum. Neither capitulum nor scutum seem to have any. Twelve pairs are located on the ventral side, two of them between the coxæ, the remainder on the opisthosoma, five of the latter in the festoons.

The same number of sensilla auriformia is found in the larvæ of *Hyalomma dromedarii* Koch (Text-fig. 2) as in *Rhipicephalus* and their arrangement is similar. In the larva of *Boophilus calcaratus* Birula (Pl. 3, fig. 7) the pair behind the third coxæ and the first pair on the edge are missing, but the remaining sensilla auriformia are as in the larva of *Rhipicephalus*.

SUMMARY

The larvæ of the Rhipicephalinæ do not possess peculiar integumentary sense organs, as K. W. Neumann (1942) believed, but rather the same types found in the nymphs and adults. The organs are merely in a more primitive state of development and the sensilla laterniformia appear to be missing. Sensilla sagittiformia, sensilla hastiformia and sensilla auriformia may be demonstrated. These organs are strictly specific in number and arrangement within the genera *Rhipicephalus*, *Hyalomma* and *Boophilus*.

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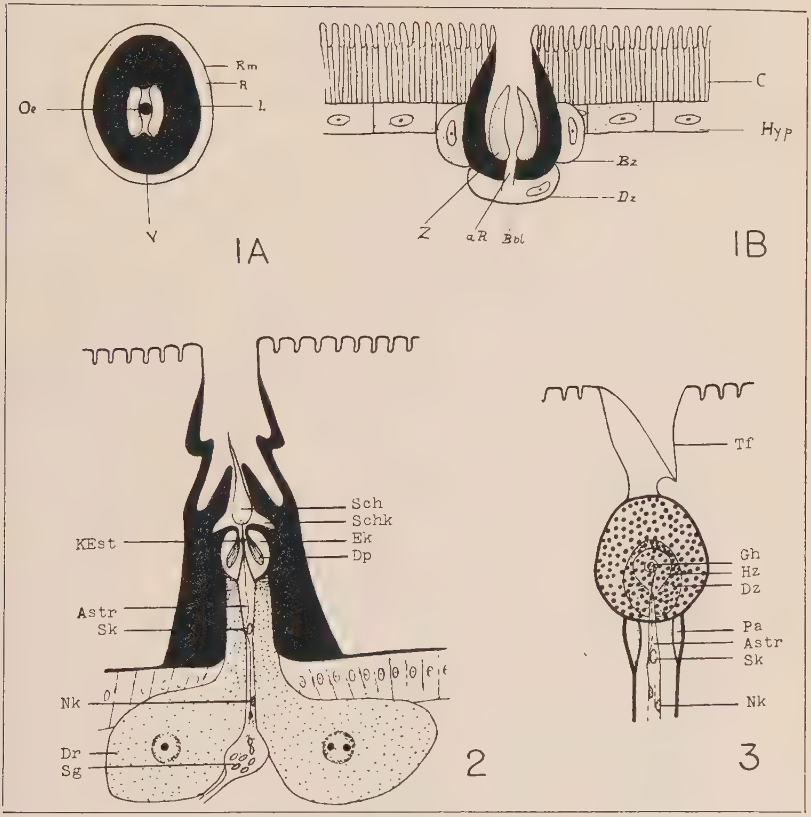
Explanation of Plate 1

Fig. 1. Larval integumentary sense organ of *Haemaphysalis punctata* Can. and Fanz., redrawn from K. W. Neumann (1942). A, in direct view; B, in side view: aR, sensory duct; Bbl, internal vesicle; Bz, generative cell; C, cuticula; Dz, gland cell; Hyp, hypodermis; L, lips; Oe, mouth of the sensory duct; R, frame; Rm, fringe; V, protrusions of the frame; Z, tooth.

Fig. 2. Schematic drawing of a sensillum sagittiforme of *Hyalomma,* after P. Schulze: Astr, axial fiber; Dp, projecting ledges; Dr, gland cell; Ek, terminal chamber; KEst, knot of the scolopale; NK, enveloping cell nucleus; Sch, tuft; Schk, tuft chamber; Sg, sensory cell group outside the duct. The chitinous structure surrounding the sense organ has been omitted.

Fig. 3. Schematic drawing of a sensillum auriforme on the alloscutum of a female *Hyalomma,* after P. Schulze: Astr, axial fiber; Dz, shaded zone of the disk; Gh, papilla with terminal apparatus in central area of the disk; Hz, unshaded zone; Nk, enveloping cell nucleus; Pa, pigmented and thickened section of the duct; Sk, sensory cell nucleus; Tf, supporting plicature. The chitinous structure surrounding the sensory organ and gland cells has been omitted. The disk covering the sensory cell and the terminal apparatus is assumed to be transparent.

PSYCHE, 1949 VOL. 56, PLATE 1

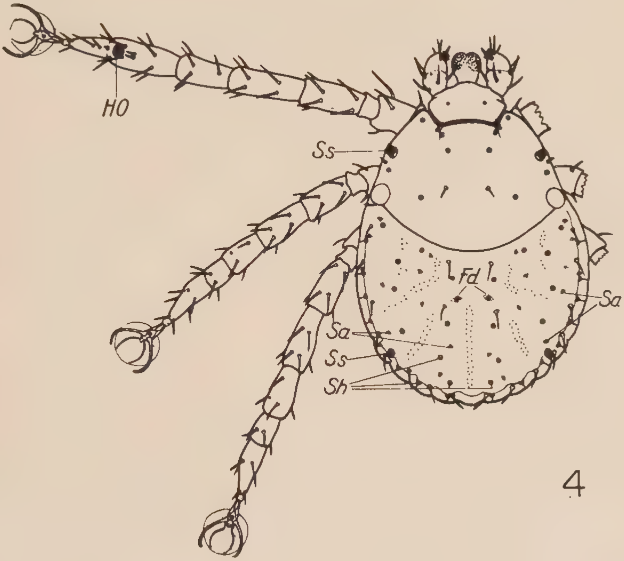


DINNIK AND ZUMPT—RHIPICEPHALINÆ

Explanation of Plate 2

Fig. 4. Dorsal view of larva of *Rhipicephalus appendiculatus* Neum., showing sensory organs: Fd, foveæ dorsales; HO, Haller's organ; Sa, sensilla auriformia; Sh, sensilla hastiformia; Ss, sensilla sagittiformia.

Fig. 5. Ventral view of larva of *Rhipicephalus appendiculatus* Neum., showing sensory organs: Sa, sensilla auriformia: Sh, sensilla hastiformia; Ss, sensilla sagittiformia.



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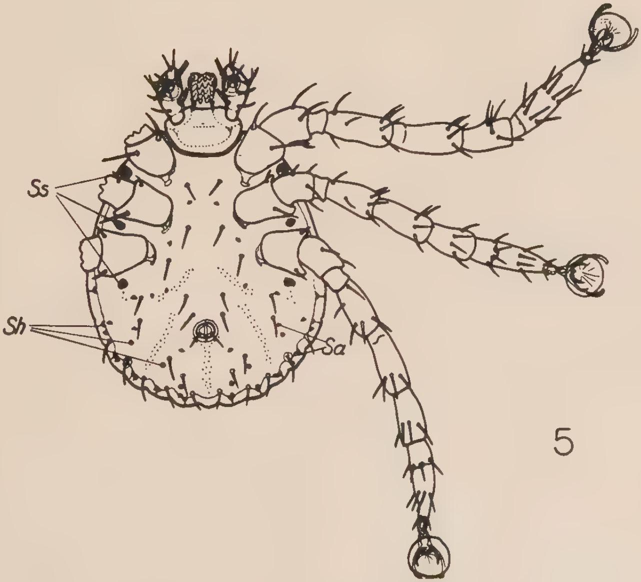

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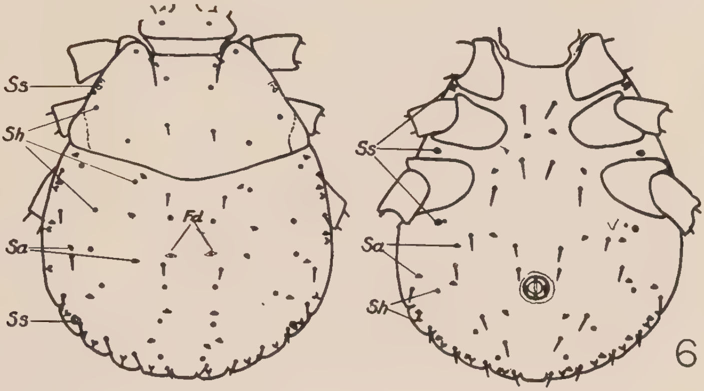
DINNIK AND ZUMPT—RHIPICEPHALINÆ

EXPLANATION OF PLATE 3

Fig. 6. Arrangement of the integumentary sense organs of the larva of *Rhipicephalus sanguineus* Latr.: Fd, foveæ dorsales; Sa, sensilla auriformia; Sh, sensilla hastiformia; Ss, sensilla sagittiformia.

Fig. 7. Arrangement of the integumentary sense organs of the larva of *Boophilus calcaratus* Birula: Fd, foveæ dorsales; Sa, sensilla auriformia; Sh, sensilla hastiformia; Ss, sensilla sagittiformia.



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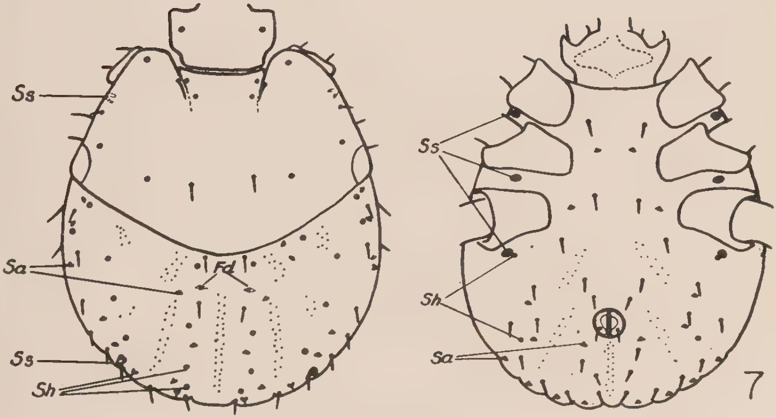

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DINNIK AND ZUMPT—RHIPICEPHALINÆ

ON THE STATUS OF *CRYPTOCERUS* LATREILLE AND *CEPHALOTES* LATREILLE (HYMENOPTERA: FORMICIDÆ)

By Marion R. Smith

Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, United States Department of Agriculture

Latreille, in Hist. Nat. Crust. and Ins., volume 3, 1802, included in the family "Formicaires" two genera, *Formica* Linnaeus and the new genus *Cephalotes*. *Cephalotes* was monobasic with *Formica atrata* Linnaeus the only included species (pp. 357–358). In volume 5, 1803, he again placed in "Formicaires" only the two genera but to the group which he had called *Cephalotes* in 1802 he gave the name *Cryptocerus* (p. 311). Distinguishing characters were given but no species were mentioned by name.

Fabricius, 1804, Systema Piezatorum, page 418, used the name *Cryptocerus* for *atratus* Linnaeus and 4 new species, including *umbraculatus;* and he cited *Cephalotes* Latreille in synonymy under *Cryptocerus atratus.*

In 1810, Latreille (Consid. Gen. Crust. Arachn. Ins., p. 437) designated *atratus* Fabricius (= *atratus* Linnaeus) as the type of *Cryptocerus*. Since *atratus* was available for type designation of *Cryptocerus,* this action by Latreille has fixed the matter beyond dispute. *Cryptocerus* Latreille is thus an isogenotypic synonym of *Cephalotes* Latreille. The interpretation of *Cryptocerus* by subsequent authors who considered *umbraculatus* Fabricius as its type is erroneous, and a new generic name is needed for *Cryptocerus* of Emery (1915) and authors, not Latreille.

On page 253 of his 1805 work Latreille says "Toutes les espèces de cryptocerès, dont la fourmi *atrata* de Lin. et de Fab. est une, sont exotiques. Ces insectes ont un caractère très remarquable, et qu'on ne trouve à aucun de cet ordre; c'est le premier article de leurs antennes qui est inséré et logé de chaque côté, dans une rainure latérale de la tête.'' In the original description of *Cephalotes* he writes ''Premier article des antennes inséré et logé, de chaque côté, dans une rainure latérale de la tête,'' and in the original description of *Cryptocerus*—''Premier article des antennes s'insérant dans une rainure de la tête.'' It seems obvious that Latreille considered *Cryptocerus* (hidden or concealed horn [antenna]) much more descriptive of the genus *Cephalotes* (having a head) and decided to use it instead.

Since the facts in this case are as just stated, the tribe receives the new name, *Cephalotini*, based on the type genus *Cephalotes*, which must be used for *Cryptocerus* of authors. The genera and subgenera involved, with synonymy and types, are as follows:

Genus *Cephalotes* Latreille

Cephalotes Latreille, 1802, Hist. Nat. Crust. and Ins. 3: 357.
Type: *Formica atrata* Linnaeus. Monobasic.
Syn.: *Cryptocerus* Latreille, 1803, Hist. Nat. Crust. and Ins. 5: 311.
Type *Formica atrata* Linnaeus. Designated by Latreille, 1810.
Syn.: *Cryptocerus* Fabricius, 1804, Systema Piezatorum, p. 418 (in part).

Emery, 1915, Bul. Soc. Ent. de France, p. 192 divided *Cryptocerus* into three subgenera: *Paracryptocerus*, n. subgen., type *Cryptocerus spinosus* Mayr; *Cryptocerus*, type *C. umbraculatus* Fabricius, and *Cyathocephalus*, n. subgen., type *Cryptocerus pallens* Klug. Except for *Cryptocerus* he listed additional species in each subgenus. In 1922, *in* Wytsman's Genera Insectorum, fascicule 174c, pp. 306, 308, he gave a detailed description of each of the above subgenera, cited the same types and listed all the known species.

Since *Cryptocerus* is not available, *Paracryptocerus* will succeed it. The correct arrangement is as follows:

Genus *Paracryptocerus* Emery, subgenus *Paracryptocerus* Emery

Paracryptocerus Emery, 1915, Bul. Soc. Ent. de France, p. 192.

Type: *Cryptocerus spinosus* Mayr. By original designation.

Genus *Paracryptocerus* Emery, subgenus **Harnedia**, new subgenus

Harnedia is proposed for *Cryptocerus* of Emery, 1915, and subsequent authors, not of Latreille. Its type is *umbraculatus* Fabricius (1804). In 1922, Emery characterized the group and listed all the known species. The name *Harnedia* is in honor of Mr. R. W. Harned from whom I have received much encouragement in my studies of ants.

The following descriptions of the soldier and worker of this new subgenus are substantially the same as given by Emery in 1922.

Soldier.—Head usually longer than wide, occasionally similar to that of *Paracryptocerus* Emery except that the head is longer and less convex above. Tubercles near the posterior border of the head usually connected by a transverse ridge which unites with the lateral borders of the head forming a surface within these borders known as a cephalic disk; anterior border of cephalic disk with a median gap which exposes the mandibles and clypeus. Thorax very noticeably more robust than that of the worker and without foliaceous border as in that caste. Epinotum with more or less distinct spines; exceptionally (*umbraculatus* Fabricius), the posterior spines of the epinotum are the longest.

Worker.—Thoracic border of variable form, sometimes spined or toothed as in *Paracryptocerus* Emery but the posterior pair of the 2 or 3 pairs of teeth on the epinotum never the longest. Border of thorax sometimes divided into 3 parts to correspond to its segments, more or less widely margined, translucent or foliaceous, and without teeth.

Genus *Paracryptocerus* Emery, subgenus *Cyathomyrmex* Creighton

Cyathocephalus Emery, 1915, Bul. Soc. Ent. de France, p. 192. Preoccupied by Kessler, 1868.

Type: *Cryptocerus pallens* Klug. By original designation.

Cyathomyrmex Creighton, 1933, Psyche 40: 98. New name.

STRUMIGENYS VENATRIX WESSON AND WESSON SYNONYMOUS WITH S. TALPA WEBER.—In the course of his studies of dacetine ants, Mr. William L. Brown, Jr. secured a loan of the type of *S. talpa* Weber (1934, Psyche, **41**: 63–65, fig. 1) from the collections of the Illinois Natural History Survey. This specimen he very kindly placed at my disposal, since I had not seen it during earlier studies on *Strumigenys* in Ohio (Wesson and Wesson, 1939, Psyche, **46**: 91–112, Pl. 3). The type of *talpa* proves to be indistinguishable from paratypes of *S. venatrix* which I had described from southern Ohio, and the latter name should be dropped.

According to Brown's recent revision of the dacetine genera, *S. talpa* should be transferred from the genus *Strumigenys* Fred. Smith to the genus *Smithistruma* Brown (1948, Trans. Amer. Ent. Soc. **74**: 101–129, 2 figs.).

—LAURENCE G. WESSON, JR., Department of Physiology, New York University College of Medicine.

THE MALE OF *PRODIDOMUS RUFUS* HENTZ (PRODIDOMIDÆ, ARANEÆ)[1]

By Elizabeth B. Bryant
Museum of Comparative Zoology

More than a century ago, in 1847, Nicholas M. Hentz, one of the first students of American spiders, found a spider in a box in a dark cellar in Alabama; it had such unusual characters that he erected a new genus and species for it. Both the generic and specific descriptions are brief, but because of the unusual arrangement of the eyes, the genus has been recognized and twenty-four species from all the warm parts of the world have been placed in it. But the genotype specimen has disappeared and the species has long evaded collectors. In 1892, Mr. N. Banks found a few immature specimens under paper in a house in Shrevesport, Louisiana, and published a short description of them. These records have been the only accounts of the American species until 1936, when an adult female was found by Miss Sarah Jones under a stone by the road-side near Dallas, Texas. This I described a few months later. Recently, when looking over some spiders in the Jones Collection, now at the Museum of Comparative Zoology, an adult male was found. This specimen was collected in a house at Denton, Texas, the 4th of December 1946, and is here described as the allotype.

Prodidomus rufus Hentz

Prodidomus rufus Hentz, Jour. Boston Soc. Nat. Hist., 1847, 5: 466, pl. 30, fig. 4; reprint, 1875, p. 105, pl. 12, fig. 4, pl. 18, fig. 9.

Male. Length, 3.0 mm., ceph. 1.7 mm. long, 1.4 mm. wide, abd. 1.5 mm. long, 1.0 mm. wide, palpus, 1.9 mm. long.

Cephalothorax pale yellow, smooth and shining, slightly convex, highest between the second coxæ, no thoracic

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[1] Published with a grant from the Museum of Comparative Zoology at Harvard College.

groove or radial furrows, anterior margin broad and slightly rounded, sides rounded, posterior margin slightly less than the anterior; *eyes* eight, anterior row straight by the upper margins, eyes equidistant, a.m.e. largest of the eight, dark, round and convex, separated by about a line, a.l.e. white, convex and round, little more than a radius of the a.m.e., posterior row strongly procurved, the same length as the anterior, eyes white and flat, p.m.e. elliptical, separated by more than the long diameter, p.l.e. elliptical, but the long axis at right angles to the p.m.e.; eyes much closer together than in the female; *quadrangle* narrower in front than behind, and higher than wide; *clypeus* below the a.m.e. about a radius of a.m.e., no hairs or bristles on the margin as in the female; *mandibles* yellow, basal third swollen, only slightly divergent, fang groove oblique, no teeth on either margin, fang long and very slender, with the base not enlarged; *labium*, a dull brown, septum distinct between the sternum, slightly wider than long, tip not rebordered; *maxillæ* about twice as long as the labium, tips inclined and almost touching, pointed, basal third very wide, origin of the palpus at the basal third; *sternum* pale, oval, four-fifths as wide as long, flat, with no hairs, ending in a point between the fourth coxæ; *abdomen* oval, and depressed, a deep red,

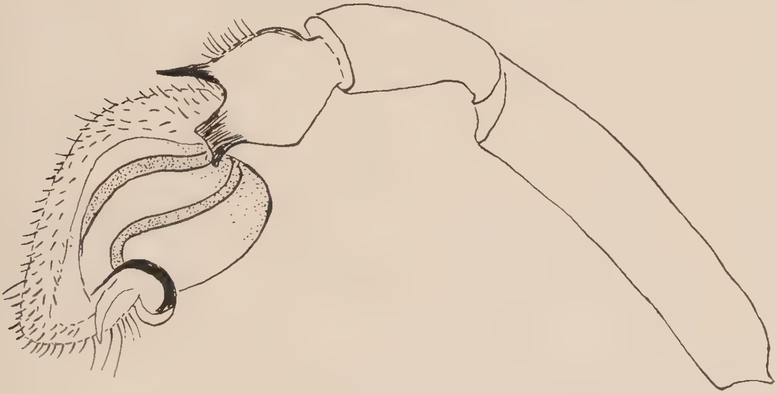
Fig. 1. *Prodidomus rufus* Hentz, left palpus.

covered with short white hairs, posterior third with no hairs and many transverse wrinkles, venter pale, spinnerets pale and smaller than in the female; *legs,* 4–1–2–3, pale, coxæ and trochanters very long, and can be seen from the dorsal side, smooth, I femur with a ventral brush of short colorless hairs, no spines, I coxæ the longest, about twice as long as wide, trochanter a little shorter and more slender, IV coxæ and trochanter subequal, and together as long as the femur, a pair of colorless ventral spines at the distal end of the IV tibia, no trichobothria at the tip of the IV metatarsus and tarsus as in the female; *palpus,* longer than the cephalothorax, femur more than half the length, pale, patella pale and slender, twice as long as wide, tibia darker, little more than half as long as the patella, tibial apophysis a slender dark dorsal spur and a broad dark lateral spur with a truncate tip, as figured, the palpal organ nearly as long as the cymbium, bulb strongly convex, pale and extending onto the tibia, the tube dark and very distinct, embolus a dark spiral coil, with the tip resting near a triangular paler point.

Allotype (♂) Texas; Denton, 4 December 1946, (Jones)

The allotype male and the neotype female were found in quite different habitats, the female out of doors, and the male in a house and they do not agree in all characters. The female is larger, pale, and only tinged with red, on the margin of the clypeus there is a fringe of hairs, and on the fourth metatarsus and tarsus are some distinct trichobothria. The male is smaller, the abdomen a deep red, covered with white hairs, the eyes are more closely grouped, the first femur has a brush of ventral hairs and the trichobothria on the fourth leg are lacking. The difference in color may be due to the habitat and the other differences are probably sexual.

In 1918–19, Dalmas published an excellent revision of the family *Prodidomidæ,* which by then included five genera, all with the same arrangement of eyes and similar spinnerets. The genotype, *Prodidomus rufus,* he knew only from the description of the immature specimens by Banks. Dalmas suggests that the Old World species placed in the genus *Prodidomus* might not belong there. In his diagnosis of the genus, he stresses two characters that are not found in the genotype. All the Old World species have the anterior median eyes the smallest of the eight, and the fourth trochanter longest, often longer than the fourth femur. This is not found in *P. rufus*. The other species from America, *P. nigricauda* Simon, 1892, and *P. opacithorax* Simon, 1892, both from Venezuela, are described with the eyes of the anterior row subequal. If the Old World species are separated from the American, the genus *Miltia,* Simon, 1870, is available as it was established for the species *Emyo amaranthius* Lucus, 1846, from Egypt. This species has the anterior median eyes the smallest of the eight, and the fourth trochanter is the longest.

In the Dalmas revision, twenty-three species of the genus *Prodidomus* have been recognized. These are found in the warm parts of the world, but only five species are known by both sexes.

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SOME FLIES OF THE GENUS *VOLUCELLA* FROM THE NEW WORLD

By F. M. Hull

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Recent studies of American Syrphid flies have disclosed a number of species of *Volucella* which appear to be undescribed. This paper presents the descriptions of these species. The types are in the author's collection.

Volucella splendens n. sp.

This bright purplish to bluish species is related to *macula* Wiedemann. It is distinguished by the general color of the abdomen and the rusty orange red face with conspicuous lateral flattened areas on either side of the tubercle. Length 14 mm.

Male. *Head:* the face, cheeks and the front, except for a small brown triangular callus, are entirely pale rusty orange in color. The facial tubercle is large and elongate, more abrupt below, with a patch of blackish pile in the middle and the remainder of the facial pile red. The frontal pile is reddish in the middle and the sides but with some black pile in the junction of the eyes. Antennæ light brownish orange, the third segment elongate, narrow upon a little more than the apical half and this apical portion with parallel sides in the male. Eyes holoptic for a long distance, flattened above with the upper facets greatly enlarged and the ocular pile dense and long and pale brownish yellow. Vertical pile black. The pollen of the face is restricted to the upper portion beneath the antennæ and is distinctly pale brownish yellow. The sides of the upper portion of the face on either side of the tubercle are distinctly flattened leaving a rather sharp ridge laterally and a corresponding well marked crease beside the tubercle; the intervening area is flattened. *Thorax:* the mesonotum is shining black, becoming diffusely brown on the notopleura, the humeri, the intervening area, the margin above the wing and the post calli. This marginal color is moderately light brown; the mesopleura, pteropleura and upper metapleura, are similarly brown, but ventrally the pleura becomes blackish. There are some bluish reflections upon the posterior half of the mesonotum in the middle and a pair of faint sublateral shining coppery vittæ. The mesonotal pile is chiefly black with five longitudinal stripes of shorter yellow pile which are restricted to the anterior half of the mesonotum and are best seen in the posterior view. The bristles of the thorax and scutellum are black; the mesopleura with one bristle, the bulbous notopleura with four, the post calli with six, the supraälæ region with three, the prescutellar region with eleven, the scutellar margin with fourteen, all of which are strong and more or less tuberculate. The scutellum is somewhat flattened and concave before the apex but without definite crease. The color of the scutellum is dark brown, over the disc which is also microgranulate, the base of the scutellum and the margin hyaline yellowish brown. Scutellum upon the disc with purplish reflections and the disc with very fine black hairs, rather long, which seem to proceed from the granulations but these hairs are scarce and scattered in all of my specimens whereas the granulations are very dense. Squamæ dark brown with brown fringe and border. *Legs:* the femora are dark reddish brown, the anterior pair and middle pair becoming lighter in color on the apical half. The hind pair are almost black especially on the dorsal margin. All of the tibiæ light coffee brown, the hind tibiæ somewhat darker and with a suggestion of a blackish brown post medial band. First three segments of anterior and middle tarsi light reddish brown, the remaining ones black. Hind tarsi similarly colored but the color a little dark. Pile of legs black. Ventral tarsal mats blackish and upon the hind pair deep reddish sepia. *Wings:* with a large, quadrate, dark sepia brown spot in the middle of the anterior half, the costal and the first basal cells, the subcostal cell brownish yellow. Marginal cell closed with a short stalk. *Abdomen:* first segment black, the remaining segments brilliant metallic blue with traces of purple reflections in the middle and very faint traces of green mixed in the blue along the lateral margins. Abdominal pile entirely black except upon the first segment and narrowly along the base of the second where it is yellowish. Sternites metallic bluish black; not so brilliant as the tergites. The pile chiefly yellow becoming black beyond the middle of the third sternite.

Female. Similar to the male in every respect with the front entirely light reddish chestnut brown divided down the middle with faint linear impressions. The pile of the eyes is more sparse but is of the same color as in the male. Third antennal segment slightly concave in the middle above, the apical portion not with parallel sides. Arista pale yellow with about twenty-five long rays.

Holotype: male, allotype female and one paratype female from Nova Teutonia, Brazil, collected by Fritz Plaumann, Jan.–April 1948.

This species traces to *macula* Wiedemann or to *panamena* Curran in Curran's key.

Volucella liriope n. sp.

A small species related to *macula* Wiedemann and *obliquicornis* Curran, the tibia are entirely reddish and the abdomen beyond the first segment is entirely black. There is a large brown spot upon the wings. Length 7 mm.

Male. *Head:* the face, cheeks and front are light yellowish brown. The tubercle is low with a patch of stiff black hairs in the middle; face otherwise with a few scattered yellow hairs and sparse yellow pollen beneath the antennæ. The frontal callus is dark brown, the frontal pile and the vertical pile black. The antennæ are elongate and entirely light brownish orange with the arista yellowish on the basal half but darker apically and with about twenty-one long rays. The eyes have the upper facets somewhat enlarged but not flattened; the ocular pile is light brownish to reddish yellow and quite thick upon the upper half. *Thorax:* mesonotum with opalescent strong greenish reflections and a coppery reflection where the light strikes. The sides of the mesonotum and the anterior margin and the upper part of the pleura are light reddish or yellowish brown in color. The mesonotal pile is black with a few pale hairs behind the humeri. The humeri are pale yellow. All pleural pile black. The bristles of the thorax and scutellum are black; there is one bristle upon the mesopleura, three on the notopleura, three above wing, three upon the post calli, six in front of the scutellum and six upon the scutellar margin. The scutellum is dark brown in color, the disc subopaque without posterior depression; the disc also has bluish to coppery reflections and is apparently devoid of pile, although fine granulations suggest that there may have been pile. There are also a few slender black hairs on each basolateral margin. Squamæ brown with dark brown border and fringe. *Legs:* the femora are brown, the hind pair quite dark, the anterior pair somewhat yellowish brown. Anterior and middle tibiæ brown, the hind pair deep sepia. First three segments of all of the tarsi rather light brownish yellow but black pilose, the mat pile on the hind tarsi light reddish yellow; terminal segments of tarsi blackish. *Wings:* distinctly greyish hyaline with a prominent, large, quadrate, sepia brown spot in the middle anteriorly; the remainder of the first basal cell is also blackish except at the base and except just in front of the large brown spot. The posterior cross-veins and the margin of the anal vein are blackish; the stigmal cell is yellow beyond the quadrate brown blotch then becomes blackish for a short distance and beyond this for nearly half of its length the stigmal cell is light brownish grey. Marginal cell closed with a rather long stalk. *Abdomen:* first segment is dark sepia brown, more or less shining; the remaining segments are black with strong opalescent bluish reflections; there is a faint brassy cast where the light strikes them.

Female. Similar to the male; the front is shining light coffee brown on the lower half becoming opalescent blackish on the upper half. There is a medial, linear impression on the upper half of the front and in the middle of the front the slightly raised portion is longitudinally striate with some of the striæ curved.

Holotype: male, allotype, female, Nova Teutonia, Brazil, Jan. to April 1948, collected by Fritz Plaumann.

Volucella impressa n. sp.

This species is related to *pinkusi* Curran and *aster* Curran but is easily distinguished by the wholly black abdomen besides other differences. There is a diffuse brown tinge in the middle of the wing, and a narrow brown stripe between the face and cheeks. Length 10 mm.

Male. *Head:* the face, except the region beneath the antennæ, and cheeks, except the posterior part, light coffee brown in color without any medial black stripe. There is, however, a slender brown stripe from the eye margin to the epistoma. The lower face is somewhat conical and slender. The low tubercle is thickly black pilose, the pile upon the sides of the face reddish yellow. Beneath the antennæ the face is blackish with pale yellow pollen which continues thinly but widely down to the epistoma. The front is sepia brown becoming black near the junction of the eyes with thin, pale brownish yellow pollen. The frontal and vertical pile is black. The eyes are not flattened, the upper facets scarcely enlarged, the ocular pile dense and sepia brown in color, not black. The antennæ are reddish brown throughout, the third segment more narrow on the apical half; the arista is yellowish basally, blackish apically, with about seventeen rather short rays. *Thorax:* the mesonotum and scutellum, except for the humeri and post calli, are entirely black with strong greenish to bluish opalescent color and coppery reflection where the light strikes. The humeri and post calli are light brownish yellow. The mesonotal, pleural and scutellar pile is black and rather dense and fine except for four longitudinal stripes of nearly white pile on the mesonotum which is most readily seen in posterior view. These stripes of pile extend fully three-fourths the length of the mesonotum with the outer pair wider. There are a very few pale hairs at the extreme base of the scutellum, but its ventral fringe is black. The bristles of the thorax are black; there is one bristle upon the mesopleura, three on the notopleura, three above wing, three on the post calli, none in front of the scutellum and ten upon the margin of the scutellum. The scutellum is concolorous with the mesonotum with a very deep, transverse, preapical depression extending the entire apical width of the scutellum. The squamæ are pale brown, the outer border, the margin and the fringe very dark sepia brown. *Legs:* black, only the extreme base of the anterior and middle tibiæ and the extreme apex of their femora yellowish brown. Pile of legs black, the ventral mat of the hind tarsi very nearly black but actually reddish sepia in the middle. *Wings:* pale brownish hyaline with more distinct but diffuse yellowish brown tinge in the middle of the wing in the whole of the stigmal portion of the subcostal cell and in the outer half of the costal cell. Marginal cell widely open. *Abdomen:* the first segment is shining black, the remaining segments black and shining with very strong opalescent greenish color and coppery reflection where the light strikes them. Hypopygium black. Sternites shining black with less conspicuous opalescent reflections. The pile of the first and second sternites widely white through the middle with a few black hairs laterally. Third and fourth sternites with more restricted white pile in the middle.

Female. Similar to the male, the front shining black throughout except upon the preantennal callus which is narrowly reddish. Frontal and vertical pile of the female black. Pile of the abdomen broadly whitish on the basal portion of the second, third and fourth segments, becoming black narrowly on the posterior border of the second segment, black upon the posterior half of the third segment and the posterior half of the fourth segment except in the posterior corners.

Holotype: male, allotype, female, one paratype female, Nova Teutonia, Brazil, collected by Fritz Plaumann, Jan.–Apr., 1948.

Volucella tripunctata n. sp.

A small species characterized by the three brown spots in the middle of the wing, the broad yellow translucent base to the abdomen. Related to *fracta* Curran. Length 7.5 mm.

Male. *Head:* face and the anterior half of the cheeks light yellowish brown. There is an indistinct medial stripe upon the face which is blackish, a distinct wide stripe from eye margin to epistoma and the posterior half of the cheeks are black. Face with yellowish white pile and the yellow pollen is restricted to the area below the antennæ. The front is black with only a little pollen along the eye margins; its pile is yellowish. The pile of the vertex is black. The eyes are not flattened but the upper facets are considerably enlarged and thickly dark reddish brown pilose; the pile extends more thinly almost to the bottom of the eye. The antennæ are light brown, the arista yellowish but black apically with about fifteen short rays. *Thorax:* the mesonotum and scutellum are shining black, the former with rather distinct purplish reflections which are not opalescent. The scutellum is slightly opalescent in reflection with a strong, complete, transverse, preapical depression which is microgranulate. The post calli and humeri are light brown; pleura black and black pilose. The mesonotal pile and scutellar pile black but with some scattered shorter yellow pile on the mesonotum which extends almost to the scutellum and is not arranged in rows. The bristles of the thorax are black; there is one bristle on the mesopleura, two on the notopleura, three above the wing, two upon the post calli, none in front of the scutellum and eight upon the scutellar margin. Squamæ very dark sepia throughout. *Legs:* the femora are black becoming obscurely dark reddish brown near the apex; the tibiæ are black, very narrowly reddish sepia at the base of the first and second pairs. Anterior tarsi black, their basitarsi brown upon the sides. Middle tarsi black with the basitarsi brown. First two segments of hind tarsi rather light reddish brown, the remaining segments black. Pile of legs black, reddish however, beneath the hind tarsi. *Wings:* very strongly tinged with yellowish brown especially upon the anterior half from which it fades and becomes paler and less yellowish posteriorly. The whole stigmal cell is rather deep brownish yellow beyond the end of the costal cell and with a slightly darker brown spot across this cell at the end of the costa. There are deep, distinct, small brownish spots on the anterior cross vein, the base of the third vein and at the base of the discal and third posterior cells. Marginal cell closed in the costa. *Abdomen:* first segment and a little more than the basal half of the second segment light yellowish and translucent. The translucent area laterally extends almost to the posterior corners but is narrowly divided in the middle by a medial blackish vitta which reaches nearly to the base of the second segment; the remainder of the second and the whole of the third and fourth segments are shining black. The pile is yellow upon the yellow areas of the first segments, widely yellow on the third segment, except immediately along the posterior margin, and yellow upon the fourth segment. Second sternite and narrow base of the third light translucent yellowish; sternal pile yellowish white.

Female. Similar to the male, the front black and shining with pale yellow pile. The marginal cell rather widely open.

Holotype: male, allotype, female and one paratype female, Nova Teutonia, Brazil, Jan. to April 1948, collected by Fritz Plaumann.

Volucella palmyra n. sp.

A small species related to *zephyrea* Curran but distinguished by the yellow pilose pleura and the entirely black front tarsi. Moreover, the entire hind tibiæ are unicolorous brownish black, not half brown. The depression of the scutellum is very shallow and oval. Length 6 mm.

Female. *Head:* the face is rather deeply conical, the tubercle moderate but the face very deeply excavated above. The face and cheeks are pale yellowish brown with a faint trace of a slender brown stripe from epistoma to eye margin. The facial pile is sparse and short and yellow, the yellow pollen restricted to the area beneath the antennæ. The front is shining black with only the area about the preantennal callus reddish brown. The pile of the front and ocellar region is sparse, short and yellow, the upper occipital pile behind the ocelli black. Eyes with sparse, short yellowish white pile.

The antennæ are light brownish orange, the third segment rather short but broad on the basal half and narrowing but little apically; the dorsal margin is flat and straight except at the base and apex. Arista yellow, black at the apex, with about fifteen rays. *Thorax:* the mesonotum is very dark sepia brown across the middle with strong bluish to purplish reflection; the blue color is arranged in faint obscure stripes. The sides of the mesonotum, the anterior margin and the post calli are light brown. The upper half of the pleura is lighter and more yellowish brown. Pleural pile brownish to reddish yellow. The mesonotal pile is short and sparse; from posterior view it appears to be chiefly light yellow with some brownish or black pile intermixed, especially in front of the scutellum; from anterior view this pile appears to be almost entirely brown to black. The bristles of the thorax are black; there is one upon the mesopleura, two upon the notopleura, three above wing, two on post calli, none in front of scutellum and six upon the scutellum margin. The scutellum is brown; it is somewhat paler down the middle and in the basal corners but with baso-lateral flattened granulate areas which show a blue reflection and which areas are not longer than wide. Beyond these flattened areas on either side the scutellum has a purplish reflection. The preapical depression is large, quite short oval, and extremely shallow and granulate. Squamæ pale brown with rather darker reddish brown fringe. *Legs:* the femora are blackish becoming yellowish to reddish brown apically. All of the tibiæ are extremely dark sepia brown and almost black throughout. Anterior tarsi black; the middle basitarsi dark brown, the remainder of the segments black. Hind basitarsi rather light reddish brown, the remaining segments black. The pile of the legs is black. *Wings:* tinged with brown which is faintly yellowish; the brown tinge is a little darker on the apical half. There is a large quadrate brown spot restricted to the subcostal cell at the end of and including the tip of the costal cell.

The marginal cell is widely open. *Abdomen:* the first segment is dark brown, the second shining black with a pair of diffusely margined yellow triangles on the base of the segment which are subtranslucent and divided in the middle by a diffuse blackish vitta. Third and fourth segments extremely dark sepia but appearing chiefly blackish especially in the middle. The pile of the second, third and fourth segments is abundant, very fine and actually entirely very pale yellowish white; in some lights it appears to be blackish.

Holotype: female, Nova Teutonia, Brazil, Fritz Plaumann; Jan.–Apr., 1948.

Volucella nigropoda n. sp.

A yellow and black species. Related to *correcta* Curran, the legs are quite black instead of reddish. More than three-fourths of the mesonotum is black with a purplish reflection. Length 7 mm.

Male. *Head:* the face and the posterior portion of the cheeks and the front are pale yellow. The face has a brownish black middle stripe becoming evanescent between the tubercle and the antennæ. There is a very wide polished black stripe from the lower eye margin to the epistoma. The pile of the front and face is pale yellow; the antennæ are pale brownish orange. The arista are pale, becoming dark only at the extreme tip; it has seventeen rays. The eyes are widely touching, the upper facets only slightly enlarged; the upper ocular pile is very dense, longer than that on the lower half and nearly black in color. This upper pile becomes thinner dorsally and posteriorly beyond the area of the enlarged facets. The lower ocular pile appears to be reddish to yellowish brown. Vertex black with a few black hairs. The eye facets extend to the posterior rim of the head upon the upper one-fourth; the occiput which is yellowish or greyish white pollinose stops at this point. Pile of the occiput very short, sparse and pale yellow. *Thorax:* the mesonotum is widely shining black with an opalescent bluish and strong coppery or purple reflection. The lateral margins are broadly pale yellow but the black medial area is considerably wider than the scutellum and occupies at least three-fifths the width of the mesonotum. The humeri are pale yellow. The scutellum is translucent, light brownish yellow without preapical depression but with a linear marginal crease or furrow running from close to the base on either side around the margin of the dorsal edge of the scutellum. The scutellum has some thirty or more fine long discal black hairs and more numerous but sparse short black hairs together with five pairs of long, slender black bristles on the margin. Mesonotum with two black notopleurals, two supra-alars and two post callar and one mesopleural bristle which are all black. Pleura pale yellow on propleura, pteropleura, metapleura, upper hypopleura and narrowly on the upper sternopleura. Remainder of pleura brownish black. Pleural pile pale yellow. Squamæ translucent greyish with sepia border and fringe, the halteres yellowish white. *Legs:* almost black; actually of a very dark blackish sepia color. The base of the anterior and middle tibiæ are a little paler in color but the difference in shade is not readily noticeable. This is also true of the base of all the basitarsi which are actually yellowish brown but heavily obscured by the black pile of the legs. The legs are almost wholly black pilose with a few scattered golden hairs towards the base of the femora. *Wings:* hyaline, the dark brown villi nearly restricted to the outer third. The basal half of the stigmal portion of the subcostal cell lying beyond the confluence of the costa and subcosta is pale yellow. The remaining outer part of this cell is hyaline. There is a diffuse brown spot in the subcostal cell below the confluence of costa and subcosta which is about twice as long as wide. There is a very small faint brown spot at the base of the submarginal cell but the cross veins are not tinged with brown. The marginal cell is barely open and is perhaps better described as closed at the costa. *Abdomen:* first and second segments quite translucent and very pale yellow with the posterior margin of the second segment rather narrowly brownish black; this band is a little wider in the middle of the segment where its band occupies not quite a third of the medial length of the segment. The base of the third segment is narrowly and diffusely yellowish translucent. This translucent area extends widely down the sides and across the posterior portion of the segment leaving a rather wide, smoky, brownish black band across the middle. The extreme margin of the third segment is narrowly black. Fourth segment chiefly yellowish brown with black posterior margin. The pile of the abdomen is yellow on the yellow areas of the first and second segments but black upon the remainder of the abdomen and quite short except upon the anterior corners of the second segment. First, second and third sternites pale yellow and yellow pilose. The third with a narrow brown post margin.

Holotype: male, Pucallpa, Peru, Dec. 4, 1947, Jose Schunke.

Volucella stigmata n. sp.

A small black species with trivittate face. Related to *fracta* Curran. The facial stripes are black, not brown, the second segment of the abdomen has a pair of distinct rounded triangles of brownish yellow. The abdomen is distinctly black, rather than violaceous brown. Length 8 mm.

Female. *Head:* face and cheeks light brown in color with a distinct, central, medial black stripe upon the face over the tubercle and another from the eye margin to the epistoma. The lower part of the front is obscure reddish brown, the upper part of the front and vertex shining black; the facial and frontal pile is pale yellow. The antennæ are yellowish brown, the arista pale yellow, reddish brown apically and there are only eight rays upon the arista; there may have been one or two others basally. The eyes have sparse, short, yellowish or brownish yellow pile. *Thorax:* the mesonotum and scutellum are black with an opalescent greenish reflection, coppery in some lights. The sides of the mesonotum are yellowish brown. There are two long, slender, black bristles on the notopleura, two above the wing, two upon the post calli, one upon the mesopleura, a single pair of large ones on the scutellum. The scutellum bears a few, lateral, fine, black hairs. The pleura are dark brown, yellowish on the metapleura and upon the suture between the pteropleura and mesopleura. The scutellum has a prominent wide preapical depression. The squamæ are pale yellow with dark brown border and fringe. The halteres are orange with pale yellow knob. *Legs:* the femora are very dark brown, the hind pair black becoming deep brown distally. All of the tibiæ are very dark reddish sepia. The tarsi are all nearly concolorous with the tibiæ. The middle and posterior basitarsi are a little lighter brown in color. Pile of the legs almost entirely black. *Wings:* hyaline except for a pale yellowish brown tinge which seems to be largely caused by the villi but may be partly caused by the wing itself. There are several brown spots on the wing. There is a quite long, deep brown spot at the confluence of the subcosta and costa which is about three or four times as long as wide; the apex of the costal cell is barely included in this spot; beyond this brown spot, in nearly the middle of the stigmal area of the subcostal cell, there is a faint rectangular brownish smudge or spot. There is a darker brown spot covering the furcation of the third vein at the base of the submarginal cell and immediately below it. There is a trace of brown about the remaining central cross-veins. The marginal cell is widely open. *Abdomen:* the first segment is brownish yellow, the second has a pair of prominent, distinct, narrowly separated, rounded and horizontally elongate triangles of brownish yellow. The remainder of this segment is shining black. The third, fourth and fifth segments are quite black with a faint, opalescent greenish reflection which in some lights is a pale brassy or reddish. First and second sternites, except the posterior margin of the second, together with the basal margin of the third sternite, brownish yellow. Remainder of sternum shining black with sparse subappressed pale yellow pile.

Holotype; female. Pucallpa, Peru, Mar. 12, Jose Schunke.

Volucella scintillans n. sp.

A brilliant metallic green and purple species. Related to *earnestina* Curran. Characterized by the black pile on the base of the apex of abdominal segment and the brown spot on the small cross vein of the wing, besides other differences. Length 9 mm.

Male. *Head:* face rather deeply projecting, brilliant metallic green above, bluish violet below. The cheeks have a large yellowish triangle and are metallic behind. There is a double band of pale yellow pubescence running from the eye margin two-thirds of the way to the epistoma. These bands are separated by the posterior border of the metallic blue part of the face; the second band lies, therefore, on the yellowish triangle of the cheeks. There is a thick band of white pollen extending from each eye margin beneath the antennæ and thence in the middle down almost to the center of the tubercle. The facial pile is fine and white and rather sparse. The front and vertex are metallic green; the frontal pile is white except for a few black hairs; the vertical pile is longer and black. The antennæ are elongate and yellowish brown. Third antennal segment perhaps a little darker in the middle and very slightly concave in the middle dorsally. The arista is yellowish brown, becoming darker apically and has about twenty-five rays. The eyes are widely touching, the upper facets only moderately enlarged, the ocular pile thick and nearly white in color. *Thorax:* the mesonotum and scutellum are brilliant metallic green with faint brassy reflections, only the humeri being yellowish brown in color. On the notopleura and all of the pleura except the metapleura the color deepens until it is a deep purplish blue over most of the pleura with less of a greenish reflection. The pile of the mesonotum and scutellum is entirely black with only a few pale hairs behind the humeri and a few more behind the transverse suture. The scutellum has a deep, preapical depression and four pairs of long, black bristles. Squamæ brownish white with a round dark brown spot; they are brown pilose on the outer edge of the upper squamæ; squamal fringe dark sepia brown.

Halteres yellowish with nearly white knob. *Legs:* black with black pile. *Wings:* nearly hyaline upon the posterior part with slightly brownish appearance due to thick brown villi. The outer part of the costal cell, the first basal cell, the basal portion of the submarginal cell and all of the marginal cell, except the apex, are pale yellowish brown. The basal half of the stigmal portion of the subcostal cell is yellowish, the remaining outer half pale brown. There is a distinct, elongate, dark brown spot just behind the point of confluence of the subcostal vein with the costa. There is a smaller brown spot upon the third longitudinal vein at the base of the submarginal cell, a larger one upon the small cross vein and a large but not quite so dark spot upon the apex of the marginal cell which extends into the submarginal cell. The marginal cell is closed with a short stalk. *Abdomen:* the first segment is black, the second, third and fourth are brilliant shining blue with greenish reflections laterally and purplish ones centrally as well as along the posterior and anterior margins of these segments. The pile of the first segment is almost entirely black, being narrowly white only in the middle. Of the second segment it is entirely black except for a broad band of yellowish white pile in the middle which extends from the base some two-thirds the length of the segment. Pile of third segment entirely black except for a few white hairs basally and sublaterally. Fourth segment's pile entirely black throughout.

Holotype: male. Pucallpa, Peru, Dec. 9, 1947, Jose Schunke.

SYNONYMIC AND OTHER NOTES ON FORMICIDÆ (HYMENOPTERA)*

By William L. Brown, Jr.
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In 1945 Dr. E. V. Enzmann published a paper entitled "Systematic Notes on the Genus Pseudomyrma."[1] Since this contains more confused taxonomy per page than any other work on the Formicidae I have ever encountered in twelve years of reading in the field, I have considered it advisable to publish an account of some of the synonymy involved.

The worst, but by no means the only, category of errors lies in the series of forms of *Pseudomyrma* described as new from the types which Wheeler had set up in his "Studies of Neotropical Ant-plants and Their Ants," published posthumously in 1942[2] and overlooked by Enzmann.

Wheeler's types were labelled *as types* in the usual Museum manner, and each series bore Wheeler's clearly legible determination label. Enzmann copied these names and used them in his paper, creating a series of synonym-homonyms, but since he made several mistakes in transcribing the spelling, some of the species may be considered synonymous but not strictly homonymous. Of the remainder of Enzmann's publication, much may be safely ignored by taxonomists, including the erratic keys and the pseudophylogenetic separation into "branches" and "groups." Some forms described as new are from sources other than the Wheeler type material; since the Enzmannian types have not been made available for study, it will devolve upon the future reviser of *Pseudomyrma*, a genus well-scrambled even in pre-Enzmannian times, to decide the fate of the species not treated here.

The species are listed as Wheeler had them, each with the corresponding Enzmannian form beneath it. To

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[1] Psyche, 51: 59–103, 3 pls. (1945).

[2] Bull. Mus. Comp. Zool. Harvard, 90: 1–262, 56 pls. (1942).

shorten the task, I have given date and page references only; plate and figure references are omitted. References to Wheeler's 1942 and Enzmann's 1945 papers are given in the preceding footnotes. The Museum of Comparative Zoology type catalog numbers are contained in parentheses with the initials (MCZ).

Pseudomyrma alliodoræ Wheeler
Wheeler, 1942, pp. 157–158.

P. allidora [sic!] E. Enzmann, 1945, pp. 77–78 (MCZ 20533).

Pseudomyrma belti subsp. *saffordi* Wheeler
Wheeler, 1942, p. 162.

P. sabanica var. *saffordi* E. Enzmann, 1945, p. 89 (MCZ 20537).

The term "*sabanica*" is evidently a misspelling of Wheeler's specific name *satanica* (*P. satanica* Wheeler, 1942, pp, 174–175), of which Enzmann considered *saffordi* a variety.

Pseudomyrma belti subsp. *venifica* Wheeler
Wheeler, 1942, pp. 162–163.

P. belti subsp. *venifica* E. Enzmann, 1945, p. 81 (MCZ 20538).

Pseudomyrma belti subsp. *bequaerti* Wheeler
Wheeler, 1942, p. 164.

P. belti subsp. *bequaerti* E. Enzmann, 1945, pp. 80–81 (MCZ 23139).

Pseudomyrma latinoda var. *coronata* Wheeler
Wheeler, 1942, pp. 167–168

P. latinoda var. *coronata* E. Enzmann, 1945, p. 88 (MCZ 20542).

Pseudomyrma latinoda subsp. *bradleyi* Wheeler
Wheeler, 1942, p. 169.

P. bradleyi E. Enzmann, 1945, p. 82 (MCZ 22864).

Pseudomyrma sericea var. *acaciarum* Wheeler
Wheeler, 1942, p. 176.

P. sericea var. *acaciorum* [sic!] E. Enzmann, 1945, p. 90 (MCZ 22865).

Pseudomyrma spinicola subsp. *sclerosa* Wheeler
Wheeler, 1942, pp. 180–181.

P. spinolæ [sic!] var. *infernalis* E. Enzmann, 1945, p. 91 (MCZ 20547).

Pseudomyrma spinicola subsp. *sclerosa* Wheeler
Wheeler, 1942, pp. 181–182.

P. spinolæ [sic!] var. *sclerosa* E. Enzmann, 1945, pp. 91–92 (MCZ 23145).

Pseudomyrma triplaridis subsp. *baileyi* Wheeler
Wheeler, 1942, pp. 185–186.

P. triplaridis subsp. *biolleyi* [sic!] E. Enzmann, 1945, pp. 93–94 (MCZ 20548).

Pseudomyrma triplaridis subsp. *tigrina* Wheeler
Wheeler, 1942, p. 186.

P. triplaridis subsp. *trigona* [sic!] E. Enzmann, 1945, pp. 94–95 (MCZ 23147).

Pseudomyrma triplaridis subsp. *boxi* Wheeler
Wheeler, 1942, p. 184.

P. triplaridis subsp. *boxi* E. Enzmann, 1945, p. 94 (MCZ 23146).

The two following forms which Wheeler saw, but refrained from describing, are easily synonymized with common species of *Pseudomyrma.*

Pseudomyrma gracilis (Fabricius)
Fabricius, 1805, Syst. Piez., p. 405 (*Formica*).

P. gracilis var. *longinoda* E. Enzmann, 1945, p. 87 (MCZ 26812).

Pseudomyrma triplarina (Weddell)

Weddell, 1849, Ann. Sc. Nat. Bot. (3) **13**: 40–113, 249–268 (*Myrmica*).

P. arboris-sanctæ Emery, 1894, Bull. Soc. Ent. Ital., **26**: 147.

P. arboris-sanctæ var. *ecuadoriana* E. Enzmann, 1945, pp. 79–80 (MCZ 26809).

The types of *ecuadoriana* are few, partially fragmented, and accompanied by what appear to be *Azteca* workers glued to the card with the *ecuadoriana.* I can see no characters which distinguish them (*ecuadoriana*) from a series of *triplarina* workers from several South American localities in the Wheeler Collection.

Following the publication of Dr. Enzmann's paper on *Pseudomyrma,* others were published by his daughter, Miss Jane Enzmann. All but one of the species described, however, appear to be synonyms of common Nearctic forms. Dr. William S. Creighton has discussed these forms with me, and I am grateful for his opinions on several obscure cases. His forthcoming book, which amounts to a revision of North American ants, will also carry notes on the synonymy of these forms, but technical difficulties prevent him from dealing with them at any length. Most species treated below involve Enzmannian names, but several other forms of older authors are changed in status as well.

Myrmecina americana Emery

M. latreillei subsp. *americana* Emery, 1895, Zool. Jahrb. Syst., **8**: 271.

M. latreillei subsp. *americana* var. *brevispinosa* Emery, idem., p. 271.

M. graminicola subsp. *quadrispina* J. Enzmann, 1946, Jour. N. Y. Ent. Soc., **54**: 13–15, figs. 1, 2, worker.

In the manuscript of his work on North American ants, which he has kindly allowed me to examine, Dr. Creighton has raised the form known for many years as *Myrmecina graminicola* subsp. *americana* to the rank of species.

There appears little objection to this move, though the differences between the Palearctic *graminicola* and the Nearctic form are very slight. The forms *quadrispina* and *brevispinosa,* however, cannot be considered valid forms.

The Enzmannian subspecies (*quadrispina*) was taken (holotype worker) on the south slope of the Blue Hills, a rather restricted elevated area just outside Boston, Massachusetts. Two colonies collected by me in this locality were confined for several months in artificial nests. Specimens killed at the time of collection and others examined after two months of rearing show a wide range of variation in size, sculpture and color. The larger workers, mostly those killed at the time of collection, agree well with the description and figures, as well as my impressions, gained from a rather cursory examination of the type, of *quadrispina.* These workers also agree with Emery's original description of *americana* and with specimens identified as *americana* by Wheeler and by Creighton.

My nests also produced, after a month or so of substarvation conditions, small light-colored workers corresponding well with published descriptions of *brevispinosa* and with specimens determined as such in the Wheeler Collection. These workers were raised from small larvæ during a period in which the colonies refused all types of prepared foods, including bread and fats. When ripe seed-heads of timothy and some small herbaceous plants were later introduced, the colony eagerly accepted the seeds as food, but the workers which had previously hatched never became, even after four weeks, as fully colored as the workers reared in the wild. I conclude that the variant *brevispinosa* is merely the stunted workers from either an incipient or poorly-nourished colony.

Both my nests were taken under large, well-embedded stones in a rich, shady beech woods. Each colony occupied a small oval chamber in the soil, about three quarters of an inch in greatest diameter and less than a quarter inch deep, with the smooth lower surface of the stone forming the immediate roof. The artificial nests were set up on the evening of collection (June 10). A few males also developed from the larvae taken with the nests, and these pupated during early August and developed into adults in late August. All the males escaped both nests through cracks during one night in early September, presumably on nuptial flight, since they had not previously attempted to leave the brood chamber which the ants constructed at the end of each nest from small particles of earth that had been scattered over the nest floor. These chambers were an almost exact replica of the ones found under the stones, open at the top and with a small passage at one side.

The queens never left the brood except on the occasion of the introduction of the first grass seed, when all the workers and one queen left the brood and examined the seeds. The queen returned after a brief period and resumed her watch over the brood.

In studying various *Myrmecina* in the Wheeler Collection, I have seen other forms of very doubtful validity. All these are presently considered subspecies of *graminicola,* under which Wheeler placed them in his original descriptions. *Texana* is supposed to differ from *americana* by its ''scotch grain'' shagreening of the first gastric segment. However, specimens from many localities in the states east of the Mississippi also possess this characteristic to a varying degree, and specimens from North Carolina and northern Ohio show much heavier sculpture of this type than do the *texana* types. The *texana* types, however, do seem to differ slightly from *americana* in having a much less definitely longitudinal orientation to the rugulation of the head, with the longitudinal rugæ having many prominent transverse spurs and branches. Other Texan specimens I have seen all belong to the typical *americana,* including a specimen identified by Wheeler as *texana.* Since sculpture appears to be one of the several very unstable features of Holarctic *Myrmecina,* I believe that further collecting in Texas and Mexico will show that this form is synonymous with *americana.*

Wheeler's two Oriental forms, *graminicola* subsp. *nipponica* and *graminicola* subsp. *sinensis,* are also doubtful. The former has the anterior clypeal tubercles developed much as in *graminicola,* and seems hardly separable from that form. The latter has the clypeal tubercles reduced and seems scarcely distinguishable from *americana.* I should not be surprised if *sinensis* were to prove to be the same as *sicula,* from the southern Palearctic region; or if both of these (*sicula* and *sinensis*) were identical to *americana.* In fact, the entire Holarctic *Myrmecina* fauna may end by being considered as one huge species cline in which the geographical races have not yet become sufficiently isolated to form distinct subspecies exclusively inhabiting a given area.

Tetramorium cæspitum (Linnæus)

Linnæus, 1785, Syst. Nat. (Ed. 10), **1**: 581 (*Formica*)

Myrmica (*Myrmica*) *brevinodis* var. *transversinodis* J. Enzmann, 1946, Journ. N. Y. Ent. Soc., **54**: 47–49, figs. 1, 2, worker.

Dr. Creighton and I are in complete agreement that this form (*transversinodis*) must be added to the long list of synonyms of the common pavement ant. Although I have not seen the type, the description, figures and notes on the habits leave little doubt of the correct placement. This ant should not be mistaken for *Myrmica lævinodis,* listed under various names and possibly a subspecies of *M. rubra,* which is an introduced form quite common in the Boston area. *M. lævinodis* sometimes enters houses, but then as solitary individuals probably brought in on clothing, as has been my frequent observation in Cambridge. This *Myrmica* possesses a very potent sting, the effects of which may last for several hours.

Crematogaster lineolata (Say)

Say, 1836, Boston Jour. Nat. Hist., **1**: 290,
all castes (*Myrmica*).

C. lineolata cerasi var. *punctinodis* J. Enzmann, 1946, Jour. N. Y. Ent. Soc., **54**: 91–92, pl. 2, fig. 7, all castes.

C. lineolata cerasi var. *wheldeni* J. Enzmann, idem., p. 92, worker.

Dr. Creighton and I agree that these two forms either represent the typical *lineolata* or intergrade with what Dr. Creighton considers subsp. *subopaca.* Enzmann has raised *cerasi* Fitch to subspecific rank, but Dr. Creighton's forthcoming book will show that this name must be dropped.

Crematogaster vermiculata Emery

Emery, 1895, Zool. Jahrb. Syst., **8**: 286.

Considered impossible of exact determination, but probably equivalent to *vermiculata* or an integrade between *vermiculata* and a subspecies, are three forms described in a paper by Jane Enzmann in 1946.[3] These all have in common the name *coachellai* and the subgeneric classification as *Crematogaster* (*Acrocœlia*), but here the consistency ends. The synonymous forms with page references to Miss. Enzmann's paper are as follows: *C. lineolata* subsp. *coachellai* "E. Enz. in lit.," p. 93, sec. iii. *C. sanguinea* subsp. *coachellai* "E. Enzmann, in lit.," p. 95, couplet 19. *C. lineolata* var. *coachellai* J. Enzmann, Pl. 2 (p. 97), fig. 3.

The first of these three names is given in a grouped list with a superficial characterization of major sections only, the second appears in a dichotomous key, and the third appears in the legend to the plate. It is doubtful whether or not the authorship should be ascribed to E. Enzmann for the first two of these, even though it seems clear that such was intended. The types of these forms have not been made available to me for study, so I consider the form *coachellai* unrecognizable in the absence of a proper description.

In still another paper by Jane Enzmann[4] the tribe *Aphænogastrini* is set up, a category which is untenable. The genera included in this "tribe" have numerous intergrades with other groups of the *Pheidolini*,[5] to which

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[3] Jour. N. Y. Ent. Soc., **54**: 91–92 (1946).

[4] Journ. N. Y. Ent. Soc., **55**: 147–152, (1947).

[5] *Pheidolini* Emery, Rend. Acad. Sc. Bologna, (1913–14).

Aphænogaster and *Novomessor* clearly belong. One astounding error is the appearance of *Lobognathus* as a *sub-genus* in the key on page 152. This appeared to be miscopy of a large label earlier placed by Dr. Creighton on an unidentified specimen of *Veromessor:* Creighton's label in the Wheeler Collection reads "*lobognathus* new subspecies." The name must be considered a *lapsus* and a synonym of *Veromessor.*[6]

Two of the species described in this paper are minor workers, probably from incipient nests, of two well-known North American ants, which are listed below.

Novomessor albisetosus (Mayr)

Mayr, 1886, Verh. Zool.-bot. Ges. Wien, **36**: 443–446, (*Aphænogaster*).

N. cockerelli var. *minor* J. Enzmann, 1947, pp. 147–148, Pl. 8, top.

Aphænogaster fulva Roger

Roger, 1863, Berl. Ent. Zeitschrift, **7**: 190.

Aphænogaster fulva var. *rubida* J. Enzmann, 1947, pp. 147–148, Pl. 8, bottom.

I have not considered other Enzmannian forms because of my unfamiliarity with the groups concerned and because of my lack of time and taste for the task. The publications considered above should certainly suggest to all who examine them the need for some means of formal nullification of the published extremes of such irresponsible taxonomy.

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[6] *Veromessor* Forel, 1917, Bull. Soc. Vaud. Sc. Nat., **51**: 235 (described as subgenus of *Novomessor*).

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